

THE FOLLOWING IS THE ENGLISH TRANSLATION OF THE
AMENDMENTS TO THE CLAIMS OF THE INTERNATIONAL
APPLICATION UNDER PCT ARTICLE 19: AMENDED SHEET
(Page 46).

SPECIFICATION

DISC RECORDING AND/OR REPRODUCING APPARATUS

TECHNICAL FIELD

The present invention relates to a disc recording
5 and/or reproducing apparatus for storing in it and
recording and/or reproducing a plurality of discs.

BACKGROUND ART

As a disc recording and/or reproducing apparatus
equipped on a vehicle for the purpose of playing a
10 sound, there is a disc player. Such a disc player
employs a method of storing a plurality of discs, for
example, compact discs (hereinafter referred to as CDs)
in a magazine and replacing a plurality of CDs in one
magazine together at a time. Since it is made
15 large-sized due to this arrangement, its main body
portion is stored in a trunk, while only portions
necessary for operation are installed in a passenger
compartment. However, since CDs cannot be replaced
when a vehicle is traveling, it is necessary to stop
20 the vehicle and open the trunk for the replacement, and
this is troublesome.

In response to this, an on-vehicle disc player to
be put in a vehicle compartment has been developed in
recent years. An on-vehicle disc player is demanded to
25 store a plurality of CDs in it and is put in a
specified space of the dashboard in a vehicle passenger
compartment. Therefore, it has been an important
problem to make an on-vehicle disc player small-sized.

Such an on-vehicle disc player forms a disc
30 storing portion by stacking one over another, for
example, six trays (disc carrying means) each carrying
a CD on it in an enclosure (case) being nearly in the

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shape of a rectangular parallelepiped having a fixed size called size 1 DIN or the like for example, and makes it possible to individually insert and eject the six CDs and makes it possible to select and reproduce one out of the six CDs.

However, since the on-vehicle disc player must store in it a plurality of CDs and contain components related to control of the respective mechanisms for performing many operations such as insertion, ejection, reproducing (recording) and the like of a CD, it has been difficult to make the whole apparatus small-sized.

Conventionally, an insertion position and a reproducing position for a CD have been offset with each other in the plane direction of the CD as shown in Figure 36. That is to say, when a CD is inserted in the conventional apparatus, the CD is caught by a pair of fins 300 fixed to a tray (omitting to show in Figure) for the CD. When the apparatus reproduces the CD, the CD has been moved from the caught position and a clearance 400 has been formed from the fins 300 to the CD in the plane direction.

Therefore, there has been a problem that the apparatus becomes large by a dimension D for the clearance 400.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide a disc recording and/or reproducing apparatus simplified in composition and made small in size.

A disc recording and/or reproducing apparatus of the present invention is characterized by a disc recording and/or reproducing apparatus comprising: a catching means for catching a disc, the catching means

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being provided in a disc mounting means for mounting the disc; a releasing means for releasing a caught condition of the disc caught by the catching means after setting the disc to a turntable while keeping a
5 direction of the disc surface; and a separating means for separating the disc from the disc mounting means in a condition that the disc is set on the turntable.

A disc recording and/or reproducing apparatus of the present invention is characterized by a disc
10 recording and/or reproducing apparatus comprising: a catching means for catching a disc, the catching means being provided in a disc mounting means for mounting the disc; a releasing means for releasing a caught condition of the disc caught by the catching means
15 after setting the disc to a turntable while keeping a direction of the disc surface; and a separating means for separating the disc from the disc mounting means in a condition that the disc is set on the turntable; wherein the catching means comprises a plate spring
20 which pushes a face of a circumferential portion of the disc.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of the appearance of a disc player showing an embodiment of a disc
25 recording and/or reproducing apparatus according to the present invention;

Figure 2 is an exploded perspective view of the disc player;

Figure 3 shows an embodiment of the present
30 invention, and figure (a) thereof is an exploded perspective view of a disc storing portion of the disc player, and figure (b) thereof is a partially cutaway

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and figure (b) thereof is an operation explaining diagram of the operation means in a state where a shutter is open;

Figure 14 is an operation explaining diagram of the operation means in a state where pushing-out levers are turned in case of ejecting the second CD from the top;

Figure 15 shows the reproducing mode for reproducing a CD, and figure (a) thereof is an operation explaining diagram of the operation means in case of reproducing the sixth CD from the top, and figure (b) thereof is an operation explaining diagram of the operation means in case of reproducing the first CD from the top;

Figure 16 shows a case of reproducing the second CD from the top, and figure (a) thereof is an operation explaining diagram of the operation means when the pin is at position D in the waiting state and figure (b) thereof is an operation explaining diagram of the operation means when the pin is at position I in the reproducing state;

Figure 17 shows the disc player at the time of inserting a CD, and figure (a) thereof is a plan view of it and figure (b) thereof is a front view;

Figure 18 is a sectional side view of the disc player at the time of inserting a CD;

Figure 19 shows a pushing-out means at the time of ejecting a CD, and figure (a) thereof is a plan view of it and figure (b) thereof is a front view; Figure 20 is a sectional side view of the pushing-out means at the time of ejecting a CD;

Figure 21 shows operation of a separating cam, and figure (a) thereof is an operation explaining

diagram showing the relation to movement of trays, and figure (b) thereof is an operation explaining diagram showing the relation to a pin;

Figure 22 is a side view showing a state before
5 the separating cam separates the trays;

Figure 23 is a side view showing a state where the trays are separated into two by the separating cam;

Figure 24 is a side view showing a state where the trays are separated into three by the separating
10 cam;

Figure 25 is a side view showing a state where the trays are separated into three and thereafter only a selected tray descends and a selected CD mounts a turntable and is held by a catching means;

Figure 26 is a side view showing a state where
15 the selected CD is held by the catching means and thereafter only the selected tray descends again and leaves the selected CD;

Figure 27 is an explanatory diagram showing a
20 state where a plate spring of the selected tray rises and the selected CD is released at the time of reproducing;

Figure 28 shows a turning force supplying means, and figure (a) thereof is an operation explaining
25 diagram showing a state where a turning force is not supplied, and figure (b) thereof is an operation explaining diagram showing a state where a turning force is supplied;

Figure 29 is an operation explaining diagram
30 showing a state where a turning force is supplied to the catching means;

Figure 30 is an operation explaining diagram showing a state where the holding means occupies the

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standby position;
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Figure 31 is an operation explaining diagram showing a state where the holding means occupies the reproducing position;

5 Figure 32 shows a state of a regulation means
when the holding means occupies the standby position,
and figure (a) is an operation explaining diagram of it
and figure (b) is a main part explaining diagram;

Figure 33 shows the regulation means when the holding means occupies the reproducing position, and figure (a) thereof is an operation explaining diagram showing a state of hindering the holding, and figure (b) thereof is an operation explaining diagram showing a state of canceling the hindrance;

15 Figure 34 is an operation explaining diagram showing a state where the holding means holds a CD due to cancellation of the hindrance by the regulation means ;

Figure 35 is an explanatory diagram showing a state that a releasing means and a separating means according to the present invention releases a CD and separates the CD from the tray at the same position as the CD catching position; and

Figure 36 is an explanatory diagram showing
25 problems of a conventional recording/reproducing
apparatus.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment of a disc recording and/or reproducing apparatus according to the present invention is described with reference to the drawings in the following.

This embodiment is a disc player for reproducing

a sound which the present invention is applied to.

(A) Whole composition of a disc player

As shown in Figures 1 to 11, in a broad way a disc player comprises a case 1 for forming its appearance, a disc storing portion 3 disposed at the front part in the case 1 and consisting of a plurality of trays 2 (disc carrying means) each of which carries a CD, a transfer means 5 provided at an insertion/ejection opening 4 of the front face plate 1a of the case 1 and inserting or ejecting a CD into or from the disc storing portion 3, an opening/closing means 6 provided at the front side of the transfer means 5 and opening or closing the insertion/ejection opening 4 of the front face plate 1a, a reproducing means 7 provided at the back part in the case 1 and selecting and reproducing one out of CDs in the disc storing portion 3, a pushing-out means 8 being provided at the right and left sides of the back of the disc storing portion 3 and pushing out a CD to be ejected toward the transfer means 5, and an operation means 9 provided mainly outside the right and left side plates 1b and 1c of the case 1 and operating the disc storing means 3, the reproducing means 7 and the like.

The reproducing means 7 comprises a space forming means 11 disposed at both sides of a pickup elevator 10 rising and lowering for forming space over and under a CD to be reproduced out of a plurality of CDs in the disc storing portion 3, a holding means 14 (driving portion) which comprises an upper arm 12 and a lower arm 13 rotatably provided on the pickup elevator 10 and enters the space and holds a selected CD, a CD driving means 15 (driving portion) being attached to the lower arm 13 and rotationally driving a CD held, a pickup

unit 16 being provided on the lower arm 13 and reading
information from a rotating CD, a turning force
supplying means 17 for transferring a driving force of
the transfer means 5 to the holding means 14 to turn a
5 CD only in the reproducing mode out of the
insertion/ejection mode being a state for
inserting/ejecting a CD and the reproducing mode being
a state for reproducing a CD, and a regulation means 18
for setting the time when the holding means 14 holds a
10 CD.

(B) Case

First, the case 1 is described. The case 1
comprises a front face plate 1a, side plates 1b and 1c,
a ceiling plate 1d and a bottom plate 1e, and its back
15 is opened. And the side plates 1b, 1c and the bottom
plate 1e are formed into one body.

(C) Disc storing portion

As shown in Figure 3(a), in this embodiment, the
disc storing portion 3 comprises six trays 2 each being
20 a disc carrying means and a disc elevator 22 carrying
the six trays 2, and at the front part of the case 1,
four guide poles 23 along the vertical direction as a
supporting means are supported by joining both their
ends to the bottom plate 1e and the ceiling plate 1d.

25 As shown in Figure 4, each tray 2 is formed by
adhering a resin member 2b to the upper face of each of
both side parts of a thin aluminum plate 2a. A pair of
pins 2c and 2d projecting sideways are formed at a
middle part and the backward part of each resin member
30 2b, and the pins being at the middle part are longer
and the pins being at the backward part are shorter.
The height of the resin member 2b is set nearly at the
same as the thickness of a CD, and the front part of a

plate spring 2e (catching means for catching a disc) for catching a CD located between the resin member 2b and the aluminum plate 2a is fixed on the upper face of the resin member 2b.

5 A pressing portion 2f for pressing a CD is formed on the inside of the backward part of the plate spring 2e, while a receiving portion 2g to be pressed down by the lower face of a separating cam 82 described later and a receiving portion 2h to receive an upward
10 force by the lower face of an upper stage entering portion 82j described later are formed on the outside of the back part of the plate spring 2e. Guide holes 2i for having the guide poles 23 inserted through into them are formed so as to pass through the resin member
15 2b and the aluminum plate 2a respectively at the front part and the back part of the resin member 2b.

 A shock absorbing member unshown is adhered along a circular arc to parts of both faces of the aluminum plate 2a which the vicinity of the outer
20 circumferential face of a CD is brought into contact with. At both ends of the resin member 2b on the top tray 2, as shown in Figure 3(a), cylindrical spring receivers 2j each receiving a coil spring 24 as an energizing means provided between the ceiling plate 1d
25 and the top tray 2 are formed into one body with the resin member 2b, and as shown in Figure 3(b), the bottom of the spring receiver 2j projects slightly inside to form a receiving part 2k and this receiving part 2k receives the lower end of the coil spring 24.
30 This is provided in order to prevent a load necessary for compressing the spring from becoming too large even if the length of compression is made large by using a long spring as the spring.

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On the other hand, the disc elevator 22 is formed in a shape in which the right and left end parts of it are bent upward. Guide holes 22a for having the guide poles 23 inserted through into them are formed in the horizontal part of it and a pair of pins 22b projecting horizontally for lifting and lowering the disc elevator 22 are fixed on the outside of each of the right and left vertical parts. The pair of pins 22b are inserted through into two vertical slits 25 formed in each of the side plates 1b and 1c of the case 1 to project outside the case 1.

The disc elevator 22 and six trays 2 are supported so as to be freely lifted and lowered by inserting the guide poles 23 through into these guide holes 22a and 2i. And the upper and lower ends of four spring guides 26 are fixed respectively on the ceiling plate 1d and the bottom plate 1e of the case 1, and the spring guides 26 are respectively inserted through into the spring receivers 2j. And the lower end of a coil spring 24 as an energizing means provided so as to surround the spring guide 26 is in contact with the receiving part of the lower end of the spring receiver 2j.

(D) Transfer means

As shown in Figure 2, the transfer means 5 is provided on the front face plate 1a of the case 1. The front face plate 1a has the insertion/ejection opening 4 formed in it. A driving shaft 30 and a driven shaft 31 are rotatably supported at the insertion/ejection opening 4. Both ends of the driving shaft 30 are rotatably attached to the front face plate 1a. Both ends of the driven shaft 31 are inserted into slots 32 formed long in the vertical direction in the sides of

the front face plate 1a.

In order to support the middle parts of the driving shaft 30 and the driven shaft 31, as shown in Figure 5, a small-diameter portion in a middle part of the driving shaft 30 is rotatably fitted into a groove 33a in the back part of a resin bearing 33 restricted in downward movement, while a small-diameter portion in a middle part of the driven shaft 31 is rotatably fitted into a groove 34a in the back part of a resin bearing 34 capable of freely moving up and down through a pair of guide projections and a pair of grooves being unshown.

A pair of rollers 35 made of resin are attached to the driven shaft 31 and a pair of rollers 36 made of rubber are attached to the driving shaft 30, and both of them are restricted by unshown stop rings in sliding in the axial directions. A circumferential groove is formed in each end of the driven shaft 31 and both ends of a spring 38 for pressing the driven shaft 31 toward the driving shaft 30 are engaged with the circumferential groove and a spring engaging pin 37 fixed on each side of the front face plate 1a.

Means for driving the driving shaft 30 is described. As shown in Figure 6, a gear 39 is fixed on the right end of the driving shaft 30, and a gear 40, a gear 41, and gears 42 and 43 formed into one body are supported so as to freely rotate inside the right side plate 1c. A worm 44 engaged with the gear 43 and a gear 45 are rotatably supported as one body on the bottom plate 1e, and the gear 45 is engaged with a worm 47 fixed on the output shaft of a transfer motor 46 mounted on the bottom plate 1e.

In order to automatically perform an operation of

the insertion/ejection opening 4 of the front face plate 1a is described. As shown in Figure 2, a shutter 64 is provided so as to freely move up and down at the front side of the front face plate 1a. An opening 64a for making a CD pass through it is formed in the shutter 64, and when the shutter 64 rises, the middle height position of the opening 64a occupies the boundary position between the rollers 35 and 36 to bring an "opened" state, and when the shutter falls, a "closed" state is brought.

That is to say, a pair of upper and lower guide pins 65 are stood at each of the right and left parts of the front face plate 1a, while a pair of vertically long guide slots 64b are formed at each of the right and left parts of the shutter 64 and a stop ring is fitted onto the fore end of each guide pin 65 inserted through into each guide slot 64b.

In order to enable the interval between the pair of slide stands 52 to become large only when the shutter rises to be "opened", the pair of guide pins 54 near the center are made longer than the other guide pins 53 and 55, and L-shaped guide slots 64c for inserting the guide pins 54 into them are formed in the shutter 64.

In order to make the shutter 64 forcibly rise to be "opened" when the interval between the pair of vertical rollers 57 is expanded and a CD is forcibly ejected for some reason, a guide rail portion 64d is formed on the upper face of this guide slot 64c.

Next, a link mechanism for opening and closing the shutter 64 is described. Guide slots 66a being long in the right and left directions are formed in the front face and underside of a lateral (right and left)

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slide plate 66 being nearly L-shaped in cross section, while guide pins 67 inserted into the guide slots 66a are fixed on the front face plate 1a and the bottom plate 1e.

5 A cam slot 64e is formed in the lower part at each side of the shutter 64, while a slide pin 66b is fixed on each end part at the front face of the lateral slide plate 66 and the slide pin 66b is inserted into the cam slot 64e. Spring engaging portions 66c and 68
10 projecting downward as shown in Figure 17(b) are formed respectively on the underside of the lateral slide plate 66 and on the underside of the bottom plate 1e, and a return spring 69 is engaged between both of them.

 A longitudinal slide plate 70 is provided on the
15 left underside of the bottom plate 1e so as to freely slide in the longitudinal (forward and backward) directions. That is to say, a pair of guide slots 70a are formed in the longitudinal slide plate 70, while an unshown gib-headed pin inserted into the guide slot 70a
20 is fixed on the bottom plate 1e.

 A bent portion of a nearly L-shaped lever 72 is rotatably attached to the underside of the bottom plate 1e through a fixed shaft 73 as shown in Figure 5, and slots 72a and 72a are formed at the end parts of the
25 lever 72. And pins 66d and 70b respectively fixed to the lateral slide plate 66 and the longitudinal slide plate 70 are slidably fitted into the slots 72a and 72a. A pressed portion 70c to be pressed by an outer slider 140 described later is formed in the longitudinal slide
30 plate 70.

(F) Reproducing means

A reproducing means 7 is arranged closely to the back of the disc storing portion 3 in order to make the

guide slot 82b is fixed at an intermediate position in the longitudinal directions of the vertical plate.

The separating cams functions not only as a space forming means 11, but also as a releasing means and a
5 separating means of the present invention, as described later.

The separating cams 82 are inserted toward the tray 2 and stably carry the tray 2 by pushing up four pins 2c and 2d at both sides of the tray 2 and form
10 space over and under the tray 2 carrying a CD to be reproduced.

The separating cams 82 each are formed in such a shape that two plates different in length in the longitudinal directions, the plates each having a slit
15 formed in it, are adhered to each other, and are composed so as to make the separating cams 82 slide into both sides of a tray 2 and thereby make the forward parts move up a pair of longer pins 2c and the backward parts move up a pair of shorter pins 2d.

That is to say, they are composed as follows. A
20 pair of first separation control portions 82c1, 82c1 are formed in order to move up a selected tray 2 carrying a selected CD and trays 2 above this selected tray 2, and a pair of second separation control
25 portions 82c2, 82c2 for moving up only the trays 2 above the selected tray 2 are formed above the first separation control portions 82c1.

Third separation control portions 82d, 82d for holding only the selected tray 2 are formed
30 respectively between the first separation control portions 82c1 and the second separation control portions 82c2. An upper face 82f for holding the positions of the pins 2c and 2d of the tray 2 over the

selected tray 2 and a lower face 82h as a position control means for holding the positions of the pins 2c and 2d of the tray 2 under the selected tray 2 and pressing the receiving portion 2g of the plate spring 2e are formed along the direction of movement of the separating cam 82.

Since the pins 2c and 2d of the selected tray 2 and the tray 2 over the selected tray 2 are pushed up by the advance of the first and second separation control portions 82c1 and 82c2, they are originally set at a fixed value such as $\theta = 45^\circ$ or the like, for example. In this case, however, the trays 2 are lifted as compressing the coil springs 24, and the higher the trays 2 are lifted, the more greatly the coil springs 24 are compressed and the load applied when pushing up the trays 2 becomes larger. In other words, the load is small at the initial stage of compressing the coil springs 24. As shown in Figure 21(a), therefore, the upper parts of the first and second separation control portions 82c1 and 82c2 take $\theta_1 = 45^\circ$ for example, while the lower parts take $\theta_2 = 60^\circ$ for example, and the intermediate parts between both of them are formed by arc-shaped faces 82t.

Next, the third separation control portions 82d, 82d are described. The third separation control portions 82d, 82d are composed of upper stage entering portions 82j, 82j, intermediate stage entering portions 82k, 82k and lower stage entering portions 82m, 82m (separating means). The upper stage entering portions 82j, 82j are used for forming space over and under a selected tray 2, the intermediate stage entering portions 82k, 82k are used for lowering the selected tray 2 and a selected CD and placing the selected CD on

washer 88 and the sleeve 87.

A sliding pin 90 stood on the lower arm 13 as shown in Figure 7 is slidably inserted through into a slot 91 formed in the upper arm 12 so that the lower arm 13 and the upper arm 12 are turned around the hollow shaft 86 synchronously with each other as one body without turning relative to each other. In order to improve the accuracy of positioning a turntable 97 described later on the lower arm 13 and a CD when the holding means 14 is turned, a supporting pole 92 stood on the bottom plate 1e is inserted through into the hollow shaft 86 on the pickup elevator 10.

(F-3) Disc driving means

A disc driving means 15 is provided on the upper face of the fore end portion of the lower arm 13. That is to say, a spindle motor 96 is mounted as shown in Figure 7, and a turntable 97 to be fitted into the central hole of a CD is mounted on the output shaft of the spindle motor 96. On the other hand, one end of a supporting plate 98 is fixed to the vicinity of the fore end of the upper arm 12 as shown in Figure 34, and the other end portion has a circular hole formed in it.

A chuck plate 99 made of resin and having a ridge-shaped convex portion formed along a circle on the underside of a disc is freely turnably fitted into the hole from above. This chuck plate 99 is prevented from slipping out by one end of an unshown spring plate fixed at the other end of it on the underside of the upper arm 12.

30 (F-4) Pickup unit

A pickup unit 16 is also mounted on the upper face of the lower arm 13 as shown in Figure 9. The composition of the pickup unit 16 is described in the

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following. An optical pickup 162 is provided so as to
freely move along the direction of length of the lower
arm 13 through a guide rail 161 formed into one body
with the lower arm 13. And a means for making the
5 optical pickup 162 reciprocate along the guide rail 161
is provided.

A screw shaft 164 is turnably supported on the
upper face of the lower arm 13 through a pair of
bearing members 163, and an unshown internal thread
10 portion of the optical pickup 162 is screwed onto the
screw shaft. The output shaft of a scanning motor 165
fixed near the sleeve 87 is geared to this screw shaft
164.

That is to say, a gear 168 having a worm wheel
15 166 and a screw gear 167 formed into one body is freely
turnably supported, and a worm 169 of the output shaft
is engaged with the worm wheel 166, while a screw gear
170 attached to the screw shaft 164 is engaged with the
screw gear 167.

20 (F-5) Turning force supplying means

The composition of a turning force supplying
means 17 for turning the holding means 14 with the
driving force of the transfer motor 46 is described in
the following. A gear train 103 is provided inside the
25 left side plate 1b of the case 1 as shown in Figure 6.
That is, the gear train 103 is composed of gears 103a
to 103h.

On the other hand, a gear 104 is also fixed on
the left end of the driving shaft 30. A plate 105 is
30 provided so as to freely move in the vertical
directions inside the left side plate 1b. That is, a
vertically long guide slot 105a is formed in the upper
part of the plate 105, and a guide pin 106 (see Figure

28) inserted through into the guide slot 105a is fixed on the left side plate 1b and a stop ring is attached to the guide pin 106.

Spring engaging portions 105b and 107 are
5 respectively provided on the lower parts of the plate
105 and the bottom plate 1e of the case 1, and a return
spring 108 for pulling down the plate 105 is provided
between both of them.

A relief hole 105c, into which a shaft 109 (fixed on the side plate 1b) of the gear 103h is inserted, is formed in the plate 105, and the base end portion of a lever 110 is turnably attached to the shaft 109. A moving shaft 111 penetrating the lever 110 is fixed on the fore end portion of this lever 110, and a gear 112 engaged with the gear 103h is turnably attached to the moving shaft 111.

A cam slot 105d is formed above the relief hole 105c in the plate 105, and a penetrating end portion of the moving shaft 111 is inserted through into the cam slot 105d. That is, when the plate 105 is moved up, the cam slot 105d is moved up and the moving shaft 111 inserted in the cam slot 105d is moved forward and thereby the gear 112 attached to the moving shaft 111 comes to be engaged with a gear 104 of the driving shaft 30.

In order to move up this plate 105, a middle portion of a lever 113 is turnably supported on the inside of the left side plate 1b through a pin 114, and one end of the lever 113 is turnably coupled to the lower portion of the plate 105 through a pin 115.

The other end of the lever 113 faces the lower part of the forward guide slot of a pair of guide slots 25 of the left side plate 1b, the guide slot having a

CD into or from the disc storing portion 3 and a reproducing mode for reproducing a CD, and the holding means 14 occupies position B as shown in Figure 30 in the former mode and occupies position A as shown in Figure 31 in the latter mode.

The turning operation of the holding means 14 between position B and position A is performed through the turning force supplying means 17 as described above. Since it is necessary to accurately position a selected CD and the turntable 97 on the lower arm 13, however, a positioning means 118 of Figure 10 is provided.

The structure of the positioning means 118 is described in the following. As shown in Figures 9 and 10, the upper end of a positioning pin 119 projecting downward is fixed on the lower arm 13 near the hollow shaft 86. On the other hand, a circular-arc slot 10c is formed in a part of the pickup elevator 10 corresponding to a range in which the positioning pin 119 moves when the holding means 14 is turned, and the positioning pin 119 is slidably fitted into the circular-arc slot 10c.

A spring engaging portion 10d projecting downward is formed on the pickup elevator 10, and both ends of a toggle spring 120 are engaged with the spring engaging portion 10d and the positioning pin 119. Assuming that a position occupied by the positioning pin 119 when the holding means 14 occupies position B or A is position b or a, position c being a middle point between b and a is an inflection point at which the direction of movement of the positioning pin 119 and the spring engaging portion 10d is arranged at a position corresponding to position c.

(F-6) Regulation means

descending to the lower end of the vertical portion 125b.

In order to make the holding means 14 not immediately perform a holding operation even when the holding means 14 turns to position A of Figure 7 and the guide pin 12a turns to the vertical portion 125b of the guide slot 125 but make the holding means 14 perform a holding operation at last when it is given a command, a first regulation means for temporarily regulating the downward movement of the guide pin 12a and a second regulation means for removing the regulation and making the holding means 14 hold a selected CD when after the regulation the separating cam 82 moves forward and then the selected CD and the selected tray 2 are lowered and placed on the turntable 97 are provided. That is to say, they are composed as follows.

As shown in Figures 7 and 30, a bearing plate 126 is stood in parallel with the separating cam 82 between the cylindrical plate 124 and the separating plate 82 on the upper face of the pickup elevator 10. A middle portion of a restriction lever 127 is turnably supported on the inside of the bearing plate 126 through a turning shaft 129 as shown in Figure 7, and a pin 127a projecting outside is fixed on the forward part of the restriction lever 127, and the backward part of the restriction lever 127 is curved inside and faces the vertical portion 125b of the guide slot 125.

And a spring 128 for pressing downward the backward part of the restriction lever 127 is provided as shown in Figure 30. On the other hand, the pin 127a of the forward part of the restriction lever 127 is loosely fitted into a cam groove 82r formed in the

guide slots 139a and 140a, and have stop rings attached to them.

5 A pair of stepped slits 141 (position control portion) for stepping up a pair of pins 77 of the pickup elevator 10 at six steps, the pins 77 projecting from the vertical slits 78, are formed in the backward part of the inner slider 139. A pair of stepped slits 142 (position control portion) for stepping up a pair of pins 22b of the disc elevator 20 at six steps, the
10 pins 22b projecting from the vertical slits 25, are formed in the forward part of the inner slider 139, and bottom slits 143 for keeping the disc elevator 22 at the lowest position and making only the pickup elevator 10 rise and fall in the reproducing mode are formed
15 continuously with and under the stepped slits 142, respectively.

On the other hand, only slits, into which a pair of pins 22b being longer pins of the disc elevator 22 are inserted, are formed in the outer slider 140. That
20 is to say, a pair of tetragon-shaped slits 144 used in the insertion/ejection mode for putting the pair of pins 22b into the stepped slits 142 and moving up and down them, a pair of horizontal line-shaped slits 145 used in the reproducing mode for putting the pins 22b
25 into the bottom slits 143 and keeping them at the lowest position, and a pair of 45°-inclined changeover slits 146 (mode changeover portion) for changing over the positions of the pair of pins 22b between the pair of stepped slits 142 and the pair of bottom slits 143
30 by moving up or down the pins 22b by means of tapered faces 146a and 146b through sliding the outer slider 140 in either direction are respectively formed continuously with one another.

Since the reproducing mode slits 145 overlap each other to be continuous with each other if these slits 145 are formed at the same vertical position, the reproducing mode slits 145, the insertion/ejection mode
 5 slits 144, the bottom slits 143, the stepped slits 142 and the pins to be inserted into them are different in height from one another.

The upper back portion of the outer slider 140 is bent perpendicularly inside to form a projecting
 10 portion 140b. A relief cutout portion 139b and a relief slit 147 are formed respectively in the backward parts of the inner slider 139 and the side plate 1b so that this projecting portion 140b can be moved together with the outer slider 140.

15 In order to enable the separating cam 82 to slide together with the outer slider 140 regardless of the height position of the separating cam 82 moving up and down together with the pickup elevator 10, an engaging groove 82s is formed along the vertical direction in
 20 the outside face of the backward part of the separating cam 82 as shown in Figure 2 and the projecting portion 140b is slidably fitted into the engaging groove 82s. And an engaging portion 140c is formed by bending the front portion of the left outer slider 140 toward under
 25 the bottom plate 1e of the case 1.

This engaging portion 140c presses backward the pressed portion 70c and opens the shutter 64 against the pressing force of the return spring 69 when the outer slider 140 slides backward.

30 Next, a driving mechanism for sliding the right and left inner sliders 139 and the right and left outer sliders 140 at the same time synchronously with each other is described. As shown in Figures 2 and 6, two

coupling shafts 148 and 149 are rotatably supported through two pairs of bearings under the backward part of the bottom plate 1e of the case 1.

Pinions 150 and 151 are fixed respectively to
5 both ends of the coupling shafts 148 and 149, and these pinions 150 and 151 are engaged respectively with racks 139c and 140d formed on the lower parts of the backward portions of the inner sliders 139 and outer sliders 140. Gears 152 and 153 are fixed respectively on the
10 coupling shafts 148 and 149, and operation motors 154 and 155 are individually geared to these gears 152 and 153. That is to say, they are composed as follows.

The operation motors 155 and 154 are mounted at the upper and lower positions inside the bearing plate
15 126 arranged at the right side of the backward portion of the case 1, and the output shafts of these motors 155 and 154 are respectively geared to the gears 152 and 153 through two sets of reduction gear means 156 and 157 provided inside the bearing plate 126. The
20 holding means of the present invention in the above-mentioned embodiment comprises the plate springs 2e and the pressing portions 2f, and the releasing means and the separating means comprises the separating cams 82.

25 Next, operation of such a disc player is described.

(I) Whole composition of the operation

The operation of the disc player is composed of three operations including the insertion of a CD into
30 the disc storing portion 3, the ejection of a CD from the disc storing portion 3 and the reproducing of a CD which selects and reproduces one CD out of a plurality of CDs stored in the disc storing portion 3.

Next, when the outer slider 140 moves backward until the pin 22b comes from the standby position of Figure 13(a) to an intermediate position in the forward and backward directions of the insertion/ejection mode slit 144, since the engaging portion 140c of the outer slider 140 presses backward the pressed portion 70c shown in Figure 2 under the bottom plate 1e, the movement of the longitudinal slide plate 70 is transferred to the lateral slide plate 66 through the lever 72 and the lateral slide plate 66 moves to the left against the pulling force of the return spring 69, and the shutter 64 rises and the insertion/ejection opening 4 is opened as shown in Figure 17(b).

Since due to the above action the shutter 64 is opened and the second tray 2 from the top has already come to the same height as the pushing-out lever 132 as described above, when attempting to insert a CD 171 between the upper and lower rollers 35 and 36 as shown in Figure 17(a), an unshown sensor arranged in the center on this side of the shutter 64 detects the CD 171 and the transfer motor 46 starts turning.

Since the turning force of the transfer motor 46 is transferred to the roller 36 through the gears, the CD 171 is pulled in between the roller 36 and the roller 35 pressed to the roller 36 by the spring 38 as shown in Figure 18 and the CD is inserted onto the second tray 2 by the rotation of the rollers 35 and 36, but since the CD 171 is only inserted just apart from the rollers 35 and 36 it is pushed in by several millimeters more by a pair of vertical rollers 57 pressed toward the center by the pushing-in springs 60.

The CD 171 is caught on the tray 2 by catching portions 2f of the pair of plate springs 2e. When the

CD 171 leaves the rollers 35 and 36, an unshown limit switch operates and the transfer motor 46 stops turning and at the same time the outer slider 140 moves forward and returns to the standby position of Figure 13(a), and therefore the pressed portion 70 which has been pressed backward is released and the shutter 64 is closed by the action of the return spring 69.

In case that the pair of pins 22b occupies another height position (first or third to sixth from the bottom) of the stepped slits 142 also, a CD can be inserted by the same operation as described above.

(K) Ejection of a CD

In case of ejecting a CD from the disc storing portion 3, for example, number button "2" and the ejection button are pressed. Thereupon, in the same way as the insertion, the pin 22b moves for example from the changeover position in the insertion/ejection mode of Figure 12 to the standby position of Figure 13(a) and the CD on the second tray 2 from the top is set to the height of the pushing-out lever 132. And in the same way as described above, when the outer slider 140 moves backward until the pins 22b come to the position shown in Figure 13(b), the shutter 64 is opened. The operation up to here is entirely the same as the operation of inserting a CD.

Next, when the outer slider 140 further moves backward until the pins 22b come to the forward parts of the insertion mode slits 144 as shown in Figure 14, as shown in Figure 19 the separating cam 82 geared to the outer slider 140 through the projecting portion 140b of the back portion of the outer slider 140 moves backward and the back of the separating cam 82 presses the back of the plate 135 to move backward.

button "2" and the reproducing button are pressed.
Hereupon, the inner slider 139 moves forward from the
state of Figure 13(a) and thereby the pins 22b descend
to the lowest position of the insertion/ejection mode
5 slit 144 to come to the mode changeover position and
thereafter the outer slider 140 moves forward.

Hereupon, the pins 22b are lowered by pressing
the upper tapered faces 146b of the changeover slits
146 (see Figure 11(c)) and are moved into the bottom
10 slits 143 and at the same time these pins 22b are moved
into the reproducing mode slits 145 of the outer slider
140 and change over to the reproducing mode as shown in
Figure 15(a). During this changeover, the pair of pins
77 of the pickup elevator 10 stay at the lowest
15 positions of the stepped slits 141.

The positions of the pins 22b at this time are
the changeover positions in the reproducing mode to the
insertion/ejection mode, and when the outer slider 140
is made to move backward from this state, the pins 22b
20 are lifted by pressing the lower tapered faces 146a of
the changeover slits 146 and can return to the
changeover position in the insertion/ejection mode as
shown in Figure 12.

The positions of the pins 22b relative to the
25 outer slider 140 shown in Figure 15(a) are not only the
mode changeover positions but also the CD selection
positions for changing only the height of the pickup
elevator 10 and selecting a CD to be reproduced.

In other words, when only the inner slider 139 is
30 made to move backward from the position of Figure 15(a),
the pair of pins 22b seem to relatively move forward in
the bottom slits 143 but are actually kept at the
lowest positions of the vertical slits 25, and

therefore the disc elevator 22 stays at the lowest reproducing position but the other pair of pins 77 hidden by the outer slider 140 not to be seen seem to relatively rise along the stepped slits 141 but actually rise along the vertical slits 78 by steps.

That is to say, when the pair of pins 22b are located at the positions corresponding to the numbers 1 to 6 given to the positions of the bottom slits 143 by making the inner slider 139 move backward, the pair of pins 77 rise or descend to the heights corresponding to the numbers 1 to 6 given in the vertical direction and a CD corresponding to the relevant number comes into a state where it can be reproduced. Figure 15(a) is a state where a CD of number 6 can be reproduced, and Figure 15(b) is a state where a CD of number 1 can be reproduced.

Since a CD of number 2 is selected here as described above, the pair of pins 77 rise to the second position from the top as shown in Figure 16(a). As a result of the above operation, a CD to be reproduced comes into a state where it can be reproduced, and the operation following this is the same also in case that a CD of any number is selected, and is performed by the movement of the outer slider 140 and the driving of the transfer motor 46.

The action after the waiting state of Figure 16(a) in which a CD of number 2 to be reproduced is selected is described in the following. A state where the pin 22b occupies position D on the outer slider 140 of Figure 16(b), namely, a state of Figure 16(a) is the waiting state, and at this time the separating cam 82 is at the position of Figure 22, and when the outer slider 140 moves forward and the pin 22b comes to

position E as the first stage, the separating cam 82 moves forward and the lower front end of the backward portion of the separating cam 82 enters between the pins 2d of the second and third trays 2 from the top
 5 (as for pins 2c also, the lower front end of the forward portion of the separating cam 82 enters between the pins 2c and the following operation is performed in the same way as pins 2d), and next, when the pin 22b comes to position F as the second stage, the pin 2d of
 10 the second tray 2 from the top slides on the first separating control portion 82c1 and mounts the upper stage entering portion 82j and the upper front end of the separating cam 82 enters between the pins 2d of the first and second trays 2 from the top to come into a
 15 state of Figure 23, and next, when the pin 22b comes to position G as the third stage, the pin 2d of the first tray 2 from the top slides on the second separating control portion 82c2 and mounts the upper face 82f of the separating cam 82. Due to this, when the pin 22b
 20 comes to position G at the third stage, space is formed over and under the selected second tray 2 from the top as shown in Figure 24.

When an unshown sensor detects that the pin 22b has come to position G of Figure 16(b), the transfer
 25 motor 46 starts turning. Since a state where the pair of pins 22b enter the bottom slits 143 and the lever 113 of the turning force supplying means 17 is pressed down has been brought when the operation mode is changed over to the reproducing mode as described above,
 30 a state has been already brought where the lever 113 is turned counterclockwise around the pin 114 from a state of Figure 28(a) and the plate 105 rises and the lever 110 is turned clockwise around the shaft 109 and the

gear 112 is engaged also with gear 104 as being engaged with the gear 103h as shown in Figure 28(b).

Accordingly, the rotation of the transfer motor 46 is transferred to the slide bar 116 having a rack 116b through the driving shaft 30 and the gear train 103, and the slide bar 116 moves backward as shown in Figure 29. Hereupon, since the engaging pin 116c of the lower backward portion of the slide bar 116 is slidably fitted in a slot 13a, the holding means 14 is turned forward and when the positioning pin 119 of Figure 10(a) passes position c being the inflection point, the pressing force of the toggle spring 120 acts in the opposite direction and the positioning pin 119 is turned to position a as shown in Figure 10(b), and as shown in Figure 24, the upper arm 12 and the chuck plate 99, and the lower arm 13 and the turntable 97 come in respectively above and below a CD 171 to be reproduced.

Showing this with plan views, the state is changed over from Figure 30 to Figure 31. The transfer motor 46 stops turning due to an unshown limit switch for detecting the turning of the holding means 14.

When the outer slider 140 moves forward until the pin 22b comes to position H of Figure 16(b) as the fourth stage, the pin 2d of the selected tray 2 descends into the intermediate stage entering portion 82k and thereby the selected tray 2 and the selected CD descend and the selected CD mounts the turntable 97 as shown in Figure 25.

At the generally same time as this, the outer slider 140 and the separating cam 82 move forward, and thereby the regulation means 18 operates and the upper arm 12 of the holding means 14 is moved down by the

action of the holding spring 89 and the CD to be reproduced is held between the turntable 97 and the chuck plate 99.

That is to say, a detailed description of the
5 holding operation is as follows. When the pin 22b is at position G and the holding means 14 occupies the standby position B, the guide pin 12a is located at the horizontal portion 125a of the guide slot 125 as shown in Figure 32, and when the holding means 14 occupies
10 the reproducing position A, the guide pin 12a moves to the vertical portion 125b of the guide slot 125 as shown in Figure 33(a), but since the pin 127a cannot be relieved to the relief part of the cam groove 82r of the separating cam 82, the guide pin 12a cannot descend
15 due to hindrance of the back face of the restriction lever 127.

Next, when the pin 22b moves to position H, since the separating cam 82 also moves forward, the pin 127a can be relieved to the relief portion of the cam groove
20 82r as shown in Figure 33(b) and the pin 127a of the restriction lever 127 pressed by the spring 128 moves up toward the relief portion of the cam groove 82r of the separating cam 82 and the backward part of the restriction lever 127 descends. Due to this, as shown
25 Figure 34 the upper arm 12 pressed by the holding spring 89 descends and the selected CD 171 is held as described above.

The turning center of the holding means 14 is positioned at a high accuracy on the bottom plate 1e by
30 inserting the pole 92 stood on the bottom plate 1e into the hollow shaft 86 being the turning center of the holding means 14, and the positioning pin 119 is held in a state where it is pressed against the pickup

elevator 10 by the toggle spring 120, and therefore the turntable 97 and the chuck plate 99 are accurately positioned on a circumferential locus.

On the other hand, since the guide pole 23 for
5 guiding a tray 2 carrying a CD 171 is also stood on the bottom plate 1e in the same way as the pole 92, the CD 171 is also accurately positioned on the bottom plate 1e. Therefore, the center of the CD 171 to be reproduced, the center of the turntable 97 and the
10 center of the chuck plate 99 coincide accurately with one another, and the CD 171 is securely held.

As the final fifth stage, when the outer slider 140 moves forward until the pin 22b comes to position I of Figure 16(b), the pin 2d of the selected tray 2
15 descends into the lower stage entering portion 82m as shown in Figure 21(a) and the selected tray 2 which has been in contact with the selected CD until that time descends as shown in Figure 26 to leave the selected CD 171 and at the same time, the receiving portion 2h of
20 the plate spring 2e which has pressed the selected CD 171 is pushed up by the lower face of the upper stage entering portion 82j of the backward portion of the separating cam 82 and thereby the selected CD is released as shown in Figure 27. An essential part
25 under this state is shown in Figures 35(a) and 35(b).

Since at this time the trays 2 under the selected tray 2 are pressed by the underside 82h of the separating cam 82 and the trays 2 over the selected tray 2 are pressed down by the coil spring 24, the
30 trays 2 are prevented from vibration caused by vibration of a vehicle.

After the selected CD is held by the holding means 14 in such a way, the CD is reproduced in a state

where the holding means 14 is held at position A as shown in Figure 31. When the spindle motor 96 rotates first, the CD is rotated through the turntable 97.

Next, when a motor 165 for scanning the pickup unit 16 rotates, its rotation is transferred to the screw shaft 164 and the optical pickup 162 moves along the screw shaft 164 from the inside toward the outside in a radial direction of the CD, and the reproducing of the CD is performed.

As described above, the selected CD 171 is easily and smoothly reproduced at the same position as the position held on the selected tray 2. Therefore, it is not necessary to produce a clearance by moving the CD in the plane direction as done in the conventional method shown in Figure 35. Further it is possible to decrease the side of the apparatus and thereby making the apparatus small in size.

After the CD has been reproduced, when the screw shaft 164 is reversely turned and the optical pickup 162 returns to its original position, the scanning motor 165 stops turning and the spindle motor 96 also stops turning. After this, according to a reverse procedure to the above-mentioned procedure, the outer slider 140 moves backward and the separating cam 82 also moves backward.

As shown in Figure 21(b), when the pin 127a returns from position H to position G, the pin 127a of the restriction lever 127 which has been at the position of Figure 33(b) comes off from the relief portion of the separating cam and moves down as shown in Figure 33(a) and the backward part of the restriction lever 127 moves up. Due to this, the guide pin 12a projecting outside from the holding means 14 is

Figure 16(b) are fitted to the pin 22b in order, and thereby the same operation as described above can be repeated.

As described above, the caught state of the disc
5 is released at the generally same position generally as the caught position of the disc without moving in the plane direction, and the disc mounting means is separated from the disc. Therefore, since it is possible to execute the reproducing and recording
10 operations by turning the disc at the generally same position as the disc caught position, it becomes unnecessary to move the disc in the radial direction (plane direction) during the reproducing and recording operations. This enables the storage dimension in the
15 radial direction of the disc to be small, and therefore it becomes possible to largely decrease the apparatus in size.

By making the changeover slit 146 longer, it is possible to make higher the lowest position of the
20 insertion/ejection mode slit 144 and make the disc elevator 22 stay at a higher position when the pin 22b comes to the position of Figure 12. Due to this, it is possible to make higher the insertion/ejection opening 4 for a CD.

25 And the above-mentioned embodiment has assumed that the number of trays forming the disc storing portion is six, but it may be less or more than six. Furthermore, this embodiment uses trays shown in Figures 3 and 4, but may use a pair of carrying pieces
30 obtained by cutting out portions shown by the alternate long and two short dashes lines in the figure, leaving only both side portions carrying the outer circumferential portion of a CD and removing the middle

part of the aluminum plate 2a.

INDUSTRIAL APPLICABILITY